

# EXHIBIT 8



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DIESEL HUB > CUMMINS > 6.7L CUMMINS SPECS

# 6.7L CUMMINS TURBODIESEL

## 6.7L CUMMINS ISB ENGINE SPECS, HISTORY, & INFORMATION


The 6.7L ISB is a Cummins B series turbodiesel introduced to Dodge Ram trucks mid-model year in 2007, phasing out the 5.9L ISB. Replacement of the 5.9L ISB was necessitated as the result of stricter Federal emissions standards in addition to the need for a more competitive platform that permitted future growth in the fiercely competitive diesel pickup and chassis cab truck vehicle categories. While the 5.9L Cummins turbodiesel had been Cummins' crown jewel since its inception in 1989, the 6.7L offered greater flexibility in meeting emissions regulations without compromising current and future power ratings. A similar engine, the 6.7L QSB, is widely used by and marketed for various commercial, industrial, and marine applications. The following information is based on the 6.7L ISB for on-highway applications, primarily focusing on Dodge/Ram Truck applications.

In addition to Dodge/Ram pickup and chassis cab trucks, the 6.7L Cummins ISB has been employed or offered by several medium duty truck manufacturers including Peterbilt, Ford Motor Company (F-650, F-750 models), Freightliner, and Kenworth, in addition to various motorhome and transit bus applications. The 6.7L Cummins has undergone several design revisions and continues to grow more powerful. Some improvements, such as the transition to a CGI engine block for 2019, aimed to improve engine reliability for the current generation of engines producing more than 1,000 lb-ft of torque at full load. The engine features a high pressure common rail injection system that used the Bosch CP3 injection pump through the 2018 model year before replacing it with the more efficient Bosch CP4 injection pump beginning the 2019 model year. For the 2021 model year, the CP3 returned to replace the CP4 due to widespread reliability problems with the CP4 injection pump experienced by all manufacturers employing it.

In Ram pickup applications, the 6.7L Cummins has been mated to a total of three transmission; 1) the 68RFE six speed automatic, 2) the Mercedes G56 six speed manual, and 3) the Aisin AS69RC six speed automatic. The AS69RC has only been offered in the high output (H.O.) variant of the 6.7L Cummins and has only been made available in Ram 3500 models. The G56 manual transmission was offered through the 2018 model year, and beginning 2019 only the 68RFE and Aisin AS69RC automatic transmissions were available. Models equipped with the manual transmission have always been significantly de-rated; for 2018, vehicles equipped with the G56

ed 660 lb-ft of peak torque to the 800 lb-ft that 68RFE models produced, while H.O. engines mated to the G56 were rated at a peak 320 lb-ft. The manual transmission was likely retired due to a lack of interest



<b>Engine:</b>	6.7L Cummins ISB (6.7ISB, ISB6.7, 6.7L Cummins Turbodiesel)	
<b>Manufacturer:</b>	Cummins Inc.	
<b>Applications/Production Years:</b>	2007.5 - 2010 Dodge Ram 2500, 3500, 4500, 5500 2011 - current Ram Trucks Ram 2500, 3500, 4500, 5500 2007 - 2015 Ford F-650, F-750 Various medium duty truck and motorhome applications	
<b>Displacement:</b>	407.58 CID (408 CID nominal), 6.69 liters (6.7 liters nominal)	
<b>Configuration:</b>	Inline 6 cylinder (I-6)	
<b>B10 Life:</b>	250,000 miles (~400,000 km)	
<b>B50 Life:</b>	350,000 miles (~560,000 km)	
<b>Bore:</b>	4.21 in (107 mm)	
<b>Stroke:</b>	4.88 in (124 mm)	
<b>Bore/Stroke Ratio:</b>	0.86 (undersquare)	
<b>Compression Ratio:</b>	<i>2007 - 2018</i>	17.3 : 1
	<i>2019+ Std Output</i>	19.0 : 1
	<i>2019+ High Output</i>	16.2 : 1
<b>Firing Order:</b>	1-5-3-6-2-4	
<b>Engine Block Material:</b>	<i>2007 - 2018</i>	Gray cast iron
	<i>2019+</i>	Compacted graphite iron (CGI)
<b>Cylinder Head Material:</b>	Cast iron	
<b>Injection System:</b>	<i>2007 - 2018</i>	Direct injection, electronically controlled Bosch CP3 high pressure common rail, 26,000 psi max injection pressure
	<i>2019 - 2020</i>	Direct injection, electronically controlled Bosch CP4.2 high pressure common rail, 29,000 psi max injection pressure
	<i>2021</i>	Direct injection, electronically controlled Bosch CP3 high pressure common rail
<b>Aspiration:</b>	Holset HE351VE variable geometry turbocharger (VGT), air-to-air intercooler	
<b>Reciprocating Assembly:</b>	<i>2007 - 2018</i>	Cast aluminum pistons, powdered metal connecting rods
	<i>2019+</i>	Cast aluminum pistons, forged alloy steel connecting rods
<b>Valvetrain:</b>	<i>2007 - 2018</i>	OHV, 4 valves per cylinder, solid roller lifters, cam-in-block
	<i>2019+</i>	OHV, 4 valves per cylinder, hydraulic lifters, cam-in-block
<b>Valve Lash (Clearance):</b>	Exhaust valves	0.020" (engine cold)



Engine Oil Capacity:	12.0 U.S. quarts w/ filter change (All Ram pickups and chassis cabs; refer to owners manual to verify oil capacity in alternative applications)	
Engine Oil Spec:	See viscosity chart at: <a href="#">6.7L Cummins service guide</a>	
Fuel:	ULSD; 2007 - 2013 models are B5 Biodiesel compatible, 2013.5+ models are B20 biodiesel compatible. Exceeding biodiesel blends in excess of B20 not advised.	
Horsepower:	350 - 420 hp, <i>see chart below</i>	
Torque:	610 - 1,075 lb-ft, <i>see chart below</i>	
Governed Speed:	~ 3,000 rpm for Ram 2500/3500 pickups	
Emissions Equipment:	2007 - 2012	EGR, DOC, NAC, DPF (DEF not required 2007 to 2012 model year Ram pickups)
	2013 - current	EGR, DOC, DPF, SCR (DEF required in 2013+ model year Ram pickups)
Engine Weight:	2007 - 2018	~1,120 lbs dry
	2019+	~ 1,060 lbs dry (engine weight reduction due primarily to transition to CGI engine block)
Engine Dimensions:	Length:	41.7"
	Width:	28.6"
	Height:	37.8"

### OVERVIEW OF MODEL YEAR CHANGES

Model Year	Notable Changes Over Previous Model Year
2008	No significant changes over the 2007.5 model year engine.
2009	An access port is added to the turbine housing of the Holset turbocharger in order to permit cleaning of the VGT vanes. A new fuel filter housing using a dual-element style filter replaces the previous design. The new housing can be retrofitted to previous engines and captures finer particles than the single filter system. In addition, the engine receives a new water inlet housing design and coolant hose/fittings for the EGR cooler.
2010	A single, engine mounted PCM is installed that controls both the engine and transmission (for automatic trucks) - previous models used a separate unit for the engine and transmission. The fuel filter housing is revised once again, now featuring a 1/4 turn drain valve on the side of the housing. A 200 °F thermostat becomes the new standard, a slightly higher operating temperature than (and not compatible with) previous model years.
2011	Selective catalytic reduction (SCR, requiring the use of DEF) becomes standard on chassis cab trucks. Torque is increased for automatic equipped trucks via a new engine calibration. Torque for manual transmission trucks and horsepower for all trucks remains unchanged.
2012	No significant changes over the 2011 model year engine.
2013	Torque is increased by 50 lb-ft for manual transmission trucks. Horsepower and torque are increased for automatic equipped trucks. A High Output variant of the engine is available in Ram 3500 models, backed by an Aisin automatic transmission. See Horsepower/Torque chart above for details. Selective catalytic reduction (SCR requiring DEF) introduced to all Cummins equipped pickups.
2014/2015	Carryover; no significant changes over previous model years.
2016	Engine recalibration, torque increased from 865 to 900 lb-ft.
2017	Carryover; no significant changes over previous model year.



	(CGI) engine block, revised camshaft, revised cylinder heads with new exhaust valves, springs, rocker arms. See sub-article below for full details. Bosch CP3 injection pump replaced by the more efficient Bosch CP4.
2020	Carryover; no significant changes over previous model year.
2021	Due to a high failure rate, Bosch CP4 injection pump replaced with Bosch CP3 injection pump. Peak output increased for H.O. models to 420 horsepower and class-leading 1,075 lb-ft of torque.

REINTRODUCTION OF HIGH OUTPUT CUMMINS VARIANT

A High Output variant of the 6.7L Cummins dubbed the "H.O." Cummins, was introduced for the 2011 model year and was only available with the 68RFE automatic transmission; it was rated at 800 lb-ft of torque while the manual transmission version of the engine peaked at 610 lb-ft. For 2013, three engine tiers were created; a standard output engine with the 68RFE automatic transmission, a low output engine for manual transmission equipped trucks, and the H.O. engine with an Aisin AS69RC automatic transmission. Since 2013, the high output 6.7L Cummins has only been available in Ram 3500 models.

6.7L CUMMINS TOPS 1000 FT-LBS OF TORQUE

The H.O. 6.7L Cummins turbodiesel received a 400 horsepower/1,000 lb-ft rating for the 2019 model year, becoming the first engine in the segment to push an engine into quadruple digit torque figures. Engine enhancements included:

- Deep skirt compacted graphite iron (CGI) engine block manufactured by TUPY; significant strength improvement over previous cast iron engine block and reduced engine weight.
- Revised piston design with low friction piston rings, enlarged wrist pin diameter. Compression ratio decreased to 16.2 : 1 for high output engines, increased to 19.0 : 1 for standard output engines.
- Forged steel connecting rods (previous engines featured powdered metal rods).
- Maintenance free, self-adjusting hydraulic lifters replace previous solid lifter/camshaft arrangement.
- Revised rocker arm and exhaust valve system.
- Cylinder head bolt diameter increased.
- Bosch CP4.2 high pressure injection pump replaces CP3 used in previous years. Max injection pressure increased from 26,000 to 29,000 psi (CP4.2 injection pump rumored to have a much higher pressure capability than being utilized by 6.7L Cummins, likely for improved reliability).
- Revised fuel injector design.
- Turbocharger upgrades, producing a maximum 33 psi of manifold pressure.
- Revised exhaust manifold; turbocharger now positioned between cylinder 4 and 5 runners (previously located centrally between cylinder 3 and 4 runners).
- Increased cooling system capacity.
- High volume oil pump.
- Water and oil pumps now reside in aluminum housings (previously cast iron).

DITCHING THE CP4 FOR THE CP3 FOR 2021

The 6.7L Cummins employed the tried-and-true Bosch CP3 injection pump through the 2018 model year. For 2019, Cummins adopted the Bosch CP4 injection pump, presumably due to its higher efficiency. However, the Bosch CP4, which GM used in the 6.6L Duramax from 2011 to 2016 and Ford has used since 2011 in the 6.7L Power Stroke, has been the source or major reliability concerns and total fuel system failures. There is much speculation as to what causes the Bosch CP4 "failure" event, but the general consensus is that ULSD fuels used in the United States lack the lubricity necessary to keep the roller followers from wearing.

The inevitable failure event flushes metal debris throughout the entire fuel system, typically requiring replacement of the fuel injectors, fuel lines, fuel pump, injection pump and necessitating a deep cleaning of the fuel tank and other associated parts. Repairs can cost in excess of \$10,000 and are generally not covered under warranty because OE's classify such a failure as "contamination" of the fuel system. As of 2021 several, if not dozens of lawsuits were pending across the U.S. seeking damages for affected GM, Ford, and Ram truck owners. Due to these reliability





All 6.7L Cummins turbodiesels employ a diesel oxidation catalyst and diesel particulate filter. 2007 - 2010 chassis cabs and 2007 to 2012 pickups utilize a NOx absorption catalyst in lieu of the selective catalytic reduction (SCR) systems Ford and GM had began employing for the 2011 model year. Ram chassis cab models adopted SCR technology for the 2011 model year while Ram pickup models would begin employing it for the 2013 model year. SCR systems require the perpetual use of diesel exhaust fluid (DEF) to convert nitrous oxides in the exhaust stream.

## FUEL DILUTION PROBLEMS IN EARLY 6.7L CUMMINS DIESELS

Fuel dilution of the engine oil become a problem as the result of how the 6.7L Cummins handled regeneration cycles. Specifically, the 6.7L Cummins relies on a post-injection sequence to raise the exhaust system and DPF temperatures during active regeneration, which cleans the DPF by burning off particulate matter that has accumulated in the DPF substrate. During a post-injection event, fuel is injected into the combustion chamber during the exhaust stroke. The fuel therefore does not burn in the combustion chamber, but rather is sent into the exhaust system as an atomized mixture. Because raw fuel is injected but not burned in the cylinder during this process, cylinder washing and fuel dilution occurred at relatively high levels and it was not uncommon for owners to see fuel dilution rates greater than 5% between oil change intervals. When SCR was employed on the 6.7L Cummins, these rates dropped significantly and later trucks are much less prone to fuel dilution problems than the 2007 to 2012 model year pickups and 2007 to 2010 model year chassis cabs.

## 6.7L CUMMINS G30 RECALL

Released October 2007, the G30 recall of the 6.7L Cummins diesel recommends replacement of the engine's oxygen sensor module and reprogramming of the ECM (engine control module). The G30 recall affects 2007/2008 model trucks built August 20th, 2007 & earlier (approx. 74,000 trucks affected). The oxygen sensor module on these trucks was found to be prone to premature failure, and the on board diagnostics (OBD II) system often does not detect the failure. The new ECM tune also enhances engine performance & drive-ability while reducing the accumulation of soot in the diesel particulate filter (reduces risk of DPF clogging).

## 6.7L CUMMINS J35 RECALL

Cummins/Dodge released the J35 recall for the 6.7L Cummins to address a variety of issues, including:

- Soot build up and clogging of the turbocharger, EGR (exhaust gas recirculation) valve, and DPF (diesel particulate filter).
- Poor fuel economy, lack of performance caused by clogging of key emissions components.
- Failure of emissions components due to clogging & excessive soot production.
- False illumination of the check engine light (malfunction indicator light).

When emissions components become clogged by soot, they function incorrectly and can negatively impact fuel economy and engine performance. The J35 recall affects 6.7L Cummins diesels model years 2007 through 2009. The recall requires reprogramming of the ECM (engine control module), a simple procedure that can be performed at your local Dodge service station. The new ECM program alters, amongst other parameters, the active regeneration strategy.

## 6.7L CUMMINS HORSEPOWER & TORQUE RATINGS

### RAM PICKUP APPLICATIONS | RAM 2500, 3500

Model Year(s)	Rated Horsepower	Rated Torque	Notes/Remarks
2007.5 - 2010 ▼	350 hp @ 3,013 rpm	650 lb-ft @ 1,500 rpm	w/ 68RFE auto trans
		610 lb-ft @ 1,500 rpm	w/ G56 auto trans



	370 hp @ 2,800 rpm	800 lb-ft @ 1,700 rpm	w/ 68RFE auto trans
	385 hp @ 2,800 rpm	850 lb-ft @ 1,700 rpm	w/ Aisin AS69RC auto trans Available in Ram 3500 models only
2015	350 hp @ 2,800 rpm	660 lb-ft @ 1,500 rpm	w/ G56 manual trans
	370 hp @ 2,800 rpm	800 lb-ft @ 1,700 rpm	w/ 68RFE auto trans
	385 hp @ 2,800 rpm	865 lb-ft @ 1,700 rpm	w/ Aisin AS69RC auto trans Available in Ram 3500 models only
2016 - 2017	350 hp @ 2,800 rpm	660 lb-ft @ 1,500 rpm	w/ G56 manual trans
	370 hp @ 2,800 rpm	800 lb-ft @ 1,700 rpm	w/ 68RFE auto trans
	385 hp @ 2,800 rpm	900 lb-ft @ 1,700 rpm	w/ Aisin AS69RC auto trans Available in Ram 3500 models only
2018	350 hp @ 2,800 rpm	660 lb-ft @ 1,500 rpm	w/ G56 manual trans
	370 hp @ 2,800 rpm	800 lb-ft @ 1,700 rpm	w/ 68RFE auto trans
	385 hp @ 2,800 rpm	930 lb-ft @ 1,700 rpm	w/ Aisin AS69RC auto trans Available in Ram 3500 models only
2019 - 2020	370 hp @ 2,800 rpm	850 lb-ft @ 1,700 rpm	w/ 68RFE auto trans
	400 hp @ 2,800 rpm	1,000 lb-ft @ 1,800 rpm	w/ Aisin AS69RC auto trans Available in Ram 3500 models only
2021	370 hp @ 2,800 rpm	850 lb-ft @ 1,700 rpm	w/ 68RFE auto trans
	420 hp @ 2,800 rpm	1,075 lb-ft @ 1,800 rpm	w/ Aisin AS69RC auto trans Available in Ram 3500 models only
2022	To be confirmed	To be confirmed	No change anticipated from prior year's ratings

<sup>[1]</sup> Beginning with trucks built February 2011; some earlier builds received 2010 model year engines.

## RAM CHASSIS CAB APPLICATIONS | RAM 3500, 4500, 5500 COMMERCIAL CAB & CHASSIS

Model Year(s)	Rated Horsepower	Rated Torque	Notes/Remarks
2007 - 2012	305 hp @ 2,800 rpm	610 lb-ft @ 1,500 rpm	w/ Aisin AS68RC auto & G56 manual trans
2013 - 2019	320 hp @ 2,800 rpm	650 lb-ft @ 1,500 rpm	w/ G56 manual trans
	325 hp @ 2,800 rpm	750 lb-ft @ 1,700 rpm	w/ Aisin AS69RC auto trans
2020 - 2021	360 hp @ 2,800 rpm	800 lb-ft @ 1,700 rpm	w/ Aisin AS69RC auto trans

## 2007 - 2015 FORD F-650, F-750 MEDIUM DUTY TRUCK APPLICATIONS

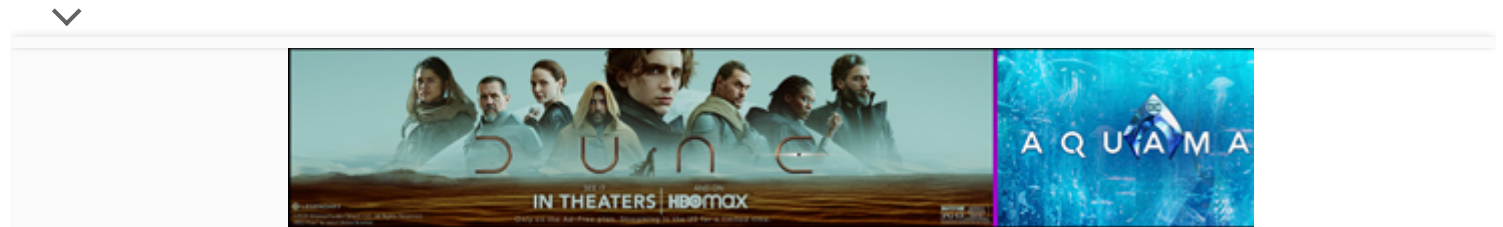
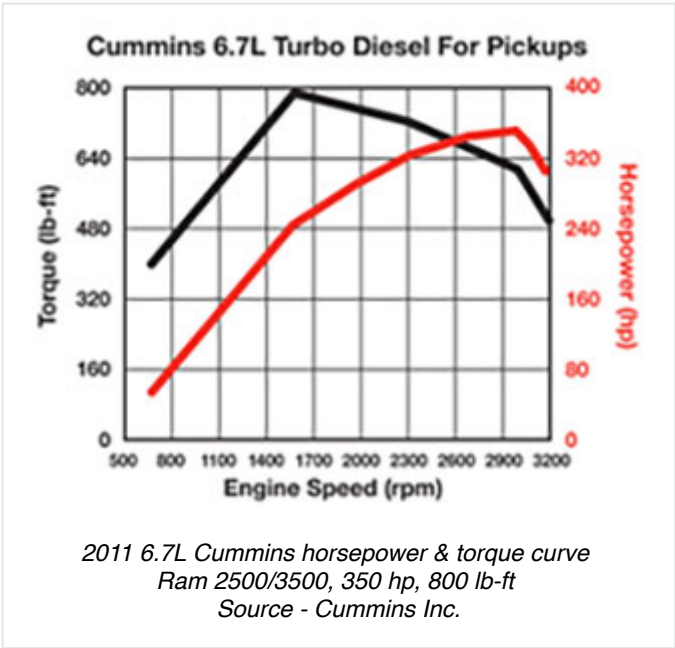
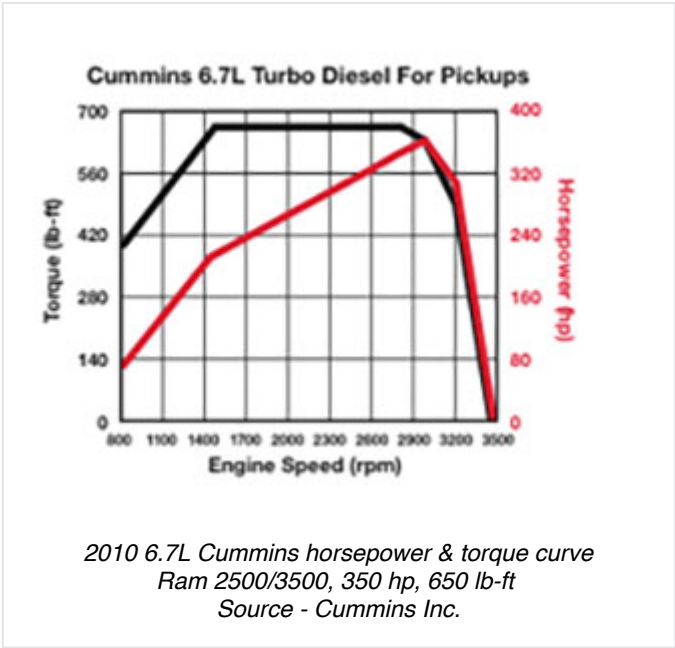
Ford Motor Company offered the 6.7L Cummins as an engine option in F-650 and F-750 medium duty truck models beginning the 2007 model year and ending the 2015 model year. During this period, the 6.7L Cummins was offered in the following horsepower and torque rating combinations:

Horsepower	Torque	Notes/Remarks
200 hp @ 2,300 rpm	520 lb-ft @ 1,600 rpm	Multiple automatic & manual transmissions available across all power levels
220 hp @ 2,300 rpm	520 lb-ft @ 1,600 rpm	

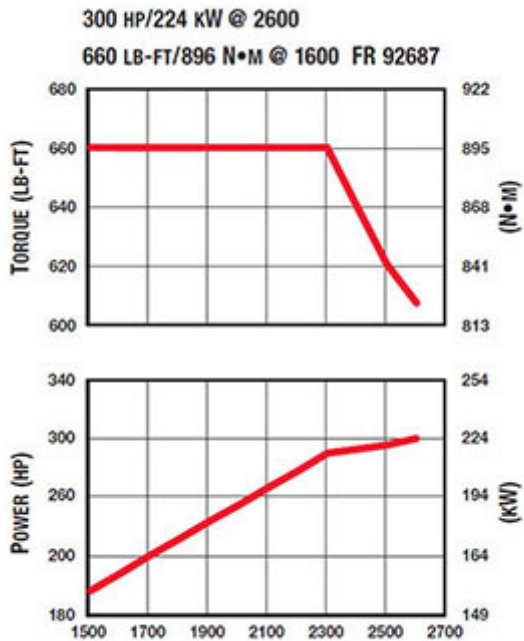


280 hp @ 2,300 rpm	660 lb-ft @ 1,600 rpm
300 hp @ 2,600 rpm	660 lb-ft @ 1,600 rpm
325 hp @ 2,300 rpm	750 lb-ft @ 1,800 rpm
340 hp @ 2,600 rpm	660 lb-ft @ 1,800 rpm
360 hp @ 3,600 rpm	800 lb-ft @ 1,800 rpm

6.7L CUMMINS HORSEPOWER & TORQUE CURVES (CHARTS)







300 hp, 660 lb-ft 6.7L Cummins variant  
Medium duty/motorhome applications  
Source - Cummins Inc.

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### 6.7L Cummins Emissions Systems Overview

### 6.7L Cummins Maintenance Schedule, Viscosity Chart, Fluid Capacities, & Service Information

### 5.9L Cummins ISB Specs, Information, & History

### 5.0L Cummins ISV5.0 Specs, Information, & History

### 6BT Cummins Specs, Information, & History

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